Introduction to Round-Table Papers

Four simultaneous Round-Table discussions on the third day of the Conference provided a time and place for questions and answers and the presentation of short papers or "statements." Although full transcripts of these Round-Table discussions are not included in these Proceedings, several of the short papers are presented within the next few pages. The discussions were all vigorous, spirited, and instructive. Major points covered in the four sessions are discussed in the summary paper of the Proceedings.

Soy Products in Composite Flours and Protein-Rich Foods

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Two aspects of my Institute's work are particularly relevant to today's discussion, and I will outline them briefly.

For some years we have been studying the uses of composite flour, i.e. blends of cereal, root, and oilseed flours which can be used partially or totally to replace wheat in products, such as bread. Our research has led us to conclude that soy flour is the most suitable oilseed flour which can be used as a protein supplement in a composite. Motivation for this work is that imports of wheat and flour into developing countries have risen by 10% a year for the past 15 years. The urban population similarly has increased, and bread is becoming an important food for townspeople. An overseas project is underway in Sri Lanka, which I reported at last year's Bogota meeting of ICC Study Group 32.

We also have studied the use of protein-rich foods for the relief of malnutrition in developing countries. In a Tropical Products Institute's paper (TPI:G73) on this, prepared for the Protein Advisory Group, United Nations, we show that, of 50 products studied in 36 countries, 24 had soy protein as the principal source of protein. Of the 17 that have ceased production or were irregular, only six had soy, whereas of the 33 that had achieved some success, there were 18.

The reasons given for the failures are interesting: non-acceptance, bad publicity, high cost, poor local raw material, or competition with a donated food.

Though use of soy protein, rather than other protein supplements, may lead to a more acceptable product, whether bread or weaning food, few developing countries yet grow soybeans in worthwhile quantities, and few process the beans to an acceptable quality flour. In some developing countries with foreign exchange earnings from commodities, such as petroleum, it is possibly more worthwhile to spend the easily come-by foreign exchange importing a high grade soy flour than endeavoring to set up a soybean agroindustry. In most cases, however, it would be worthwhile for governments to stimulate soybean production. The economics must be studied carefully, giving consideration particularly to the value placed upon foreign exchange—this, after all, is the principal reason for having composite flour programs. If soybeans cannot yet be grown and foreign exchange is scarce, other sources of protein that can be grown should be studied, rather than continuing to import soy products indefinitely.

Use of Soy Flours in Bakery Products

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INTRODUCTION

I would like to discuss two aspects of the use of soy flour in bakery and pastry products: the use of soy flour as a source of protein and the use of soy flour as an additive.

There are two types of soy flour: the crude soy flour in which the natural enzymatic system has not been inactivated and the toasted soy flour in which the enzymatic system has been destroyed to improve the nutritional value. Each of these types can be produced as either full fat or defatted flour.

We also must differentiate between two types of doughs in which these soy flours can be used: leavened doughs and sweetened doughs.

ENZYME ACTIVE AND INACTIVE SOY FLOURS

For the production of bread, for example, we advise the use of the enzyme active flours. These flours contain, among other enzymes, the lipoxygenase which enables the oxidation of the lipid-protein linkage and causes hydrolyzation, leading to a superior dough development.

In addition, the lipoxygenase produces peroxides, which in turn oxidize the carotinoids of the flours, producing a whiter bread.

The quantities of enzyme active soy flour that are being used vary between 0.2 and 1% wheat flour, depending upon the quality. In addition, products like ascorbic acid, potassium bromate, and iodate will add to the oxidation process.

In doughs made for the production of toast bread and rusks, with more complex recipes and higher fat and sugar contents, we advise using enzyme inactive soy flour at higher percentages, ca. 5% wheat flour. It is the physical properties of the soy proteins that are important, especially their ability to retain water, thus producing a softer product that keeps longer. Since it is this action of the protein we are most interested in, we recommend using defatted enzyme inactive soy flour.

I would like to add, however, to achieve the full effect of the soy proteins, one should not use less than 5% with good quality wheat flours. With lower quality flours, there will be a decreased volume. However, this can be adjusted easily by hydrating the dough more and by adding emulsifying agents and oxidants, if desired.

Certain manufacturers of soy flours recommend the use of conditioners based upon soy flour containing special additives for the manufacture of toast bread, rusks, and viennoiseries. In this case, there is better tolerance of the dough; a better workability; a larger volume of the finished product; a finer and more aerated crumb; a finer crust with a good color; higher yield; lower fat, sugar, and possibly egg content; a softer crumb due to the higher moisture content of the finished product; and an improved taste.

These conditions also will facilitate the freezing of viennoiserie products. Unbaked or partially baked doughs dry out much less and reduce the denaturation of the yeast, while permitting work under more constant rheological conditions.

Beside all the functional advantages of soy flour, I also would like to mention its use in enriched bread, hypocaloric and hypoglucidic bread containing 15, 20, or 30% proteins, according to new French law on dietetic products. From this bread one can produce rusks with 20, 33, and 52% proteins. In these particular applications, soy flour can replace 50% normal added gluten.

Finally, I would like to mention the use of soy flour in sweetened doughs, which is the starting point for pastries and biscuits. In pastry making, the enzyme inactive soy flours are used especially for their ability to retain water and their emulsifying powers. Because of the presence of phosphatides and soluble proteins, they permit the production of a less expensive product, since the amount of eggs and fat can be reduced, while the finished product contains more water. In addition, the equilibrium relative humidity will be lowered, leading to a finished product with a longer shelf life. The quantity of soy flour to use varies between 10 and 20% wheat flour.

In biscuit production, the enzyme inactive soy flours also are used in quantities of ca. 5%. The advantages include a better yield, the possibility of manufacturing products that are less fragile and crisper, and the reduction of the formation of a gluten network which causes less retraction during the fabrication process. In addition, it allows for easier reuse of trimmings, controls the gelatinization of starch during baking, and gives a product which is more easily detached from the mold.

To conclude, we can say that the good quality soy flours one finds today on the European market have many applications in bakery products, pastry, and biscuits for a competitive price.

In the enzyme active types of soy flours, the action of the lipoxygenase is the most important quality, while, in the enzyme inactive flours, the functional and nutritional properties of the proteins take precedence. Soy proteins also supplement the amino acid lysine, which is usually low in most cereals, especially wheat.

Use of Soy Products in Cereal Products

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WHEAT FOODS AS VEHICLE FOR NUTRITIONAL IMPROVEMENT

Wheat based foods are the most logical vehicle for nutritional improvement via vitamin or mineral enrichment or protein fortification with soy flour because: (A) wheat foods are widely consumed and accepted, (B) modern mills provide focal points in developing countries for nutrient additive, (C) bread and cookies are often the only centrally prepared convenience food in the marketplace, and (D) the basic technology for providing soy fortified bakery products with high acceptability now is known.

Soy flour is the only consistent, economical protein resource currently available for fortification programs of any significant size. Protein fortification in developing countries must be based upon imported soy flour until indigenous protein resources and processing industries can be developed.

SOY FLOUR IN BREAD

Soy fortified wheat flour now is being purchased under Title I and Title II, PL 480, for use in school lunch, institutional feeding, and other commodity distribution programs aimed at nutritional improvement. Two forms of the soy fortified flour are available, i.e. containing 6% and 12% soy flour. The 6% product contains 94% bread wheat flour and 6% defatted toasted soy flour. The 12% product contains 88% bread wheat flour and 12% defatted soy flour. Both products are enriched with vitamins and minerals and contain sodium stearoyl-2-lactylate, a dough conditioner which offsets the detrimental functional and flavor effects associated with addition of high levels of soy flour.

These blended products have been shown to be quite versatile and are being used in breads of all types, cookies, sweet goods, cakes, noodles, and baby food gruels.

The protein efficiency ratio (PER) of bread is normally in the range of 0.7-1.0, and bread normally will have a protein content of 8%. Bread made with 6% soy fortified flour will have a PER of 1.3 and a protein content of 10%. Bread made with the 12% soy fortified flour will have a PER of 1.9 and a protein content of 11.5%.

Cookies have a PER of 0.5 and a protein content of ca. 5%. Cookies made with 12% protein fortified flour will have a PER of 1.5 and a protein content of 8%.

FLOUR COST

Over the last year, the price of soy fortified wheat flour has been ca. 10% more expensive than wheat flour. This increase in flour cost is offset partially by savings in